BIOSOLIDS TREATMENT AND COMPOSTING USING VIROSOLID™ & VIROBLEND™ REAGENTS

VIROSEWAGE™ TECHNOLOGY TECHNICAL DATA SHEET

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OVERVIEW

The objective of using ViroBlend™ and ViroSolid™ reagents as additives in composting is to stabilise biosolids or sludges by immobilising metal ions, dramatically reducing odour and the propensity for biosolids and sludges to develop odour over time, and enhancing their use in the production of a horticultural supplement in order to reduce their impact on the environment.

The ViroSewage™ Technology composting process utilises a range of proprietary products to stabilise bio-solids in order to facilitate their disposal and enhance their use in composting carbonaceous waste, such as green waste.

The process is directed at biosolids sludges separated from wastewater, such as sewage or other industrial wastewater, during conventional treatment processes. However, biosolids from any other source are equally benefited.

In addition to stabilising biosolids to facilitate their disposal, ViroSewage™ Technology stabilised biosolids or sludges can be used to enhance the composting of carbonaceous wastes:

- The bulk density and filterability of the sludge component of the biosolids are improved;
- Odours from, and the development of odour in, biosolids used as an adjunct to composting are virtually eliminated;
- The rate of composting of the biomass is accelerated and thereby the temperature of the composting mass is increased and the pathogen content of the composted mass is substantially reduced;
- The amount of carbonaceous matter required to produce suitable compost is reduced;
- The water retention capacity of the composted mass is increased;
- The development of odour during the composting process and subsequent storage of the composted mass is eliminated;
- The metal ions in the composted mass are immobilized in a non-leachable, non-bioavailable geochemically stable form.
- The bulk density, particulate nature and filterability of the solids precipitated from the wastewater are improved thereby reducing the amount of filter aid, typically polyelectrolyte flocculating agent, required to dewater the solids;
- Biosolid sludges and biosolids are stabilised so as to allow environmentally acceptable disposal or reuse as a fertilizer; and
- Phosphate, a common limiting nutrient in algal growth and eutrophication, is removed from wastewater, and bound to the ViroSewage™ reagent in a plant available but non-leachable form.

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The ViroSewage™ Technology composting process may be applied to any conventional process of composting, whether in-vessel, wind row or by any other means, where the composted product results from the biological decomposition of organic wastes, agricultural or urban wastes, specifically but not necessarily limited to sewage wastes.

The improvements as described above are achieved:

- By adding ViroBlend™ reagent to the separated organic or inorganic biosolids from any source; or
- By adding ViroSolid™ reagent to wastewater containing biosolids prior to the separation of the biosolids; or
- By adding ViroSolid™ reagent to the wastewater after preliminary separation of the solids, so that the metals and phosphates are removed, and subsequently by adding the phosphorus-rich sludge to previously separated biosolids.

The ViroSolid™ reagent addition may be made at any stage in the normal wastewater treatment process. Where the biosolids are intended for use in composting, the separated sludge- ViroSolid™ reagent mixture is subsequently added to the biomass used in the composting process.

Specifically, and in the case of sewage treatment, the ViroSolid™ reagent additions are advantageously, but not necessarily, carried out as part of the typical metal ion and phosphorus removal process after secondary clarification and nitrogen reduction has been completed, and the ViroSolid™ reagent-phosphorus sludge is subsequently admixed with the biosolids separated by the primary and secondary clarification processes prior to dewatering.

TECHNICAL ADVANTAGES

1. Bulk Density of Biosolids

Typically, the biosolids component of the composting biomass is produced from a clarification process in the form of sludge with a solids content of 0.5-1.0 %. After dewatering the sludge in the presence of a filter aid such as a polyelectrolyte, either by belt filtration, dissolved air flotation or other means, the solids content increases to 10-12%. The addition of ViroSolid™ reagent to the sludge, either as an aid to or after clarification, provides a biocake with a solids content of 14-17%, and requires only 40-55% of the normal polyelectrolyte dose due to improved dewatering efficiency.

The clarification process may be part of any water or sludge treatment process whether part of a conventional sewage treatment process or any other process which may involve the separation of solid waste from liquid waste streams.

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2. Elimination of Odour from Biosolids

Typically, the biosolids mixed into carbonaceous waste to form a compostable biomass are odourous as received and continue to generate odour during storage and during the composting process. The addition of ViroSolid™ reagent to the biosolids either during or after separation virtuallly eliminates existing odour and also prevents the generation of odour during storage and composting. This property of the ViroSolid™ reagent therefore obviates any legislative inhibition of operations due to the stringent controls on odour discharge to the environment imposed by local and environmental authorities.

3. Acceleration of the Rate of Composting

In a typical composting operation, dewatered biosolids sludge (the so-called "biocake") is mixed in a 1:4 ratio with imported green waste using a front-end loader. It is then composted in windrows for 11-14 weeks, turned regularly to aerate the composting mass, and the final product used for various agricultural and horticultural purposes. When ViroBlend™ reagent is added to the biosolids, or to the composting mass, the time taken for completion of the process is reduced to 6-8 weeks. The criteria used for completeness of the composting reaction are pH 7-8 and a compost internal temperature less than 50°C.

4. Reducing the Amount of Carbonaceous Matter Required

As indicated above, the typical ratio of biosolids to green waste is 1:4, however in the presence of ViroBlend™ Reagent this ratio can be reduced to about 1:2.5 without loss of product quality.

5. Water Retention of the Finished Compost

A valuable property of compost is the ability to absorb large amounts of water without losing its structural integrity. Compost produced in the presence of the ViroBlend™ reagent absorbs up to 10 x its weight of water without becoming a sludge where as compost produced from similar green waste and biosolids in the absence of the ViroBlend™ reagent becomes liquid when added to five times its weight of water.

6. Stabilisation of Biosolid Sludges

The relevant Authorities define the characterisation of the immobilization of metal ions in waste solid matter discharged to the environment by the Toxicity Characteristic Leaching Procedure (TCLP; USEPA Method 1311), and discharges to the environment of odorous wastes are similarly subject to regulation. Untreated sludges containing toxic metals may fail both these criteria, whereas sludges obtained by the ViroSewage™ Technology process have been demonstrated to be almost completely free of odour and to pass the TCLP test.

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APPLICATIONS

1. Laboratory-scale investigations

Laboratory-scale investigations into treatment of biosolids sludge were conducted. The results show that a marked increase in percent solids of biocake of between 3-5% was achievable. Additionally, a reduction of 60% of polyelectrolyte required was achieved and there was a dramatic reduction in odour from both treated liquor water and biocake.

Following successful laboratory scale trials, it was decided to scale up and perform trials at a municipal sewage treatment plant.

2. Pilot plant testing on raw sludge and biosolids sludge from a municipal sewage treatment plant

Bulk density and filterability trials

The recovered phosphate-rich sediment from 1,000L trials was harvested and mixed with the biosolids liquor prior to filtration to test for belt-press efficiency. Several ratios of biosolids to recovered sediment have been tested and the quantity of polyelectrolyte required for filtration of the harvested sediment/biosolids mix has been varied.

It is demonstrated that the ViroSolid™ reagent treated biosolids require only 40% of the normal amount of polyelectrolyte used, treated biosolids agglomerate very well and belt-press compression and de-watering consistently yield higher solids content than untreated biosolids.

Biosolids odour and storage trials

Both treated and untreated biocake were stored in open and closed containers for several weeks and their odours compared at regular intervals. Qualitative odour levels were determined subjectively by three independent observers.

- For treated and untreated biocake stored in sealed containers, odour of the untreated biosolids was found to be strongly objectionable, however odour from the treated biosolids was assessed as “detectable, but not objectionable”. Visual differences between the two samples were also noted.
- The biocake stored in open buckets exhibited the greatest differences in odour. Untreated biocake developed a very strong, objectionable, “rotting sewage” odour whereas treated biocake odour was described as like “moist earth” with no objections from observers. Even after three weeks, no objectionable odours were detected from treated biosolids.
- The treated biocake has been shown to meet the Australian New South Wales EPA guidelines for disposal and re-use in agriculture.

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3. Production-scale biosolids stabilization trials at a municipal sewage treatment plant

Bulk density and filterability trials

Two 1,000L plastic containers were used to dispense the ViroSolid™ reagent into the biosolids stream prior to a belt press. The addition rate of polyelectrolyte was decreased to 7.25 mL/L or 53% of normal dosage rate and the treated biosolids were de-watered on the belt press, collected in the truck and removed for composting trials (see below). The belt speed and tension of the gravity belt were adjusted for optimum use.

The resultant biocake had a different texture (being more "spongy", than biocake produced in the absence of ViroSolid™ reagent) and had no objectionable odours. The test was continued for the entire day with a total of 415 kilolitres being processed. The percent solids was calculated by sewage treatment plant staff to be 14%, compared with untreated biocake solids at 10.5%.

In another similar test, the ViroSolid™ reagent treated biocake "stood up" to an angle of approximately 50 degrees in the truck necessitating it to be spread in the truck to fill up the "dead" spots. A total of 494 kilolitres of biosolids liquor were treated with resultant percentage solids of 14.2%.

4. Composting trials at a commercial composting facility

At this facility the biocake is normally transferred by truck from the municipal treatment plant and then mixed in a 1:4 ratio by weight with imported green waste using a front-end loader. It is then composted in windrows for 11-14 weeks being turned regularly to aid in composting, and the final product used in council parklands.

For this test, the biocake from the bulk density and filterability trials was unloaded into two piles and then mixed with green waste in 1:2.25 and 1:3 ratios. The piles were turned regularly and observations recorded by the loader operator.

The ViroBlend™ reagent treated 1:2.25 and 1:3 piles both stood up well and did not sag or collapse. Large clouds of steam were released from the 2 piles, during movement by heavy plant equipment. Temperatures were determined utilising standard thermocouple probes during the composting process and shown to exceed 75°C with an average temperature in excess of 65°C. No leaching from either pile was evident, even after rain events, and minimal odour was detected throughout the process.

After ten days the 1:2.25 pile was deemed to be slowing down so it was dosed with dry sawdust, which then raised the temperature to 49°C and was allowed to continue composting. After two weeks both piles were in excess of 60°C with no unpleasant odour. The colour of the two piles was a dark chocolate brown.

After seven weeks the treated biosolids/green waste mix had a pH of 7-8 and internal temperature average of 50°C or less and the composting process was deemed to be complete and the product ready for use.

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The trial demonstrated that, in the presence of ViroBlend™ reagent:

- The rate of composting was increased markedly and reduced the production time from 11-14 weeks to seven weeks;
- The temperature of the composting mass exceeded 75°C within 24 hours and averaged 65°C. This temperature exceeds the normal pasteurising temperature required destroy pathogens; and
- The ratio of biocake to carbonaceous waste (green waste) required to produce a satisfactory product was decreased from 1:4 to 1:2.25.

5. Compost odour and storage trials

Five hundred litres of biosolids liquor was placed in a plastic container along with the required amount of treatment reagent and half the usual amount of polyelectrolyte. The solution was stirred and let stand for 30 minutes.

The treated biosolids were placed onto the belt-press and de-watered. The resultant biocake was collected and placed into two 200L black plastic drums with sealable lids, along with green waste from the local public tip in 1:1 and 1:3 ratios.

An identical experiment was conducted using untreated biosolids for standardisation and control comparisons. The drums were all left in a sunny position, watered, rolled and subjectively tested for odour daily over a one-month period. The drums containing treated biocake consistently exhibited low odour compared with the untreated biosolids drums and composted to a smaller volume than the untreated material.

After three months none of the ViroBlend™ reagent treated biosolids composting trials have exhibited any offensive odours or leachate. The test was repeated with the same results.

SAFETY AND ENVIRONMENT

The use of ViroSewage™ Technology ViroBlend™ and ViroSolid™ reagents, in composting operations is both environmentally sustainable and economically viable. Moreover, ViroSewage™ Technology reagents consist of minerals that are not known to pose any environmental hazard and are classed as non-hazardous materials.